DOCUMENT RESUME

ED 445 668 IR 020 268

TITLE	Connecting Learners: The South Carolina Educational Technology Plan.
INSTITUTION	South Carolina State Dept. of Education, Columbia.
PUB DATE	1998-10-00
NOTE	75p.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Computer Uses in Education; *Educational Planning; *Educational Technology; Elementary Secondary Education; Faculty Development; Statewide Planning; Telecommunications
IDENTIFIERS	South Carolina; *Technology Plans

ABSTRACT

This educational technology plan for South Carolina contains the following sections: (1) statewide progress related to the telecommunications infrastructure, professional development, video infrastructure, administrative infrastructure, and funding; (2) introduction to educational technology concepts, including major components and factors contributing to success; (3) how to use this plan; (4) a scenario involving schools, technology, and the state's economy; (5) mission, vision, and beliefs; (6) technology planning, including a framework to help schools and districts to chart their course in technology planning and a technology plan checklist; (7) the key elements of effective district planning for educational technology; (8) funding for technology; (9) connecting learners--curriculum, standards, and technology, including information literacy, national educational standards, grade specific standards and assessments, new strategies and opportunities, changing roles, resources for educators, and technology and assessment; (10) connecting teachers through professional development, including ISTE (International Society for Technology in Education) recommended competencies for educators, as well as roles and responsibilities of various organizations; and (11) systems and support, including hardware and software, connectivity/network design, physical design, and technical support and systems maintenance. Related World Wide Web sites are listed. (Contains 20 references.) (MES)

Reproductions supplied by EDRS are the best that can be made
from the original document.

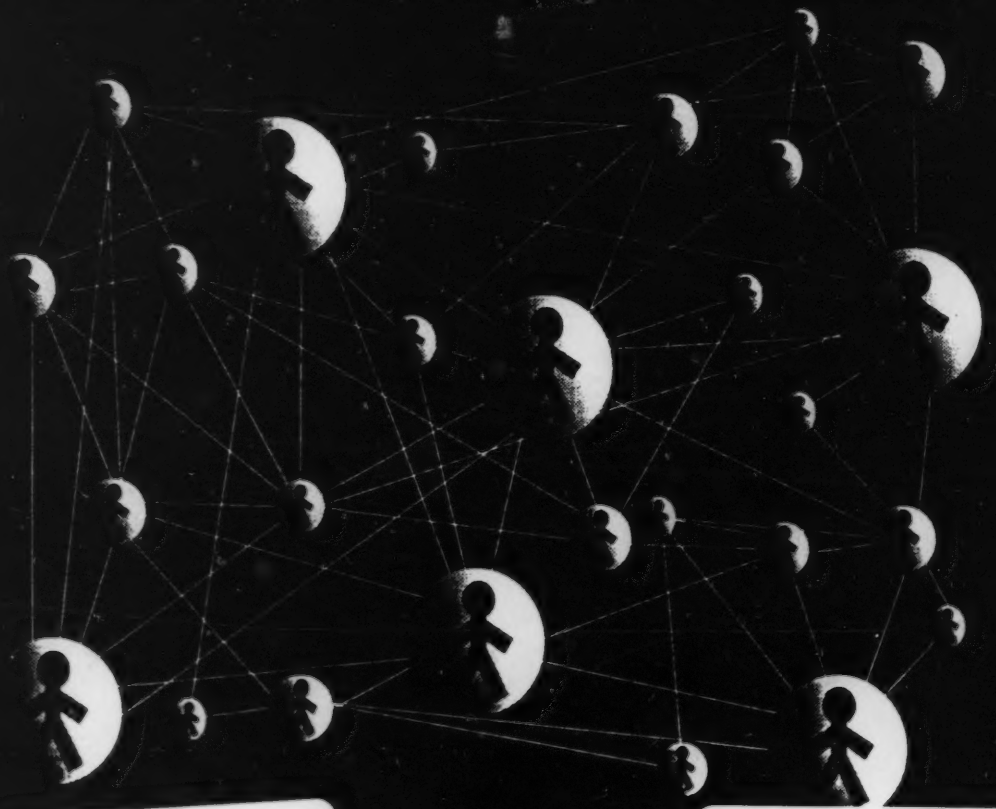
ED 445 668

IR

CONNECTING LEARNERS

The South Carolina Educational Technology Plan

A Publication of the South Carolina Department of Education



PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

J.H. Foster

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

IR020268

STATE OF SOUTH CAROLINA
DEPARTMENT OF EDUCATION

Dr. Barbara Stock Nielsen
State Superintendent of Education

October 19, 1998

To the People of South Carolina:

When the South *Carolina Educational Technology Plan* was presented in November 1995, it contained a vision for the technology South Carolina's students would need to access to achieve economic, educational, and personal success. Since then, we have made tremendous progress in meeting these goals. In presenting this enhanced version, we retain the spirit and intent of the original plan. That blueprint for systemwide educational reform laid a foundation for continued growth and renewal.

Connecting Learners: The South Carolina Educational Technology Plan, which we present in two formats, reflects the rapidly changing world of learning and technology. This print version provides recommendations and an overview of the information resources and tools that will enable our students to achieve high academic learning standards. The web-based document is a dynamic resource, providing relevant, up-to-date hyperlinks, thus connecting educators with the most current information available.

Because technology must be applied to our daily lives, it is our responsibility as educators and parents to ensure that each child, as a citizen in the Information Age, has the skills and attitudes necessary to meet the challenges of a rapidly changing world. As evidenced by the South Carolina curriculum frameworks and standards, high ideals for student achievement at both the state and national level drive the goals we set for learning. The emphasis on standards for informational and technology literacy is inherent in this plan.

Students are at the heart of this plan. As adults who will be employed in careers not even envisioned at this time, South Carolina's students have the challenge to use technology in a manner that will make them, and thus the Palmetto State, successful. This is a responsibility shared by each of us -- whether as a parent, educator, or leader in community, industry or business. Forging partnerships that connect our learners with all those who share a stake in South Carolina's future must be the strategy that empowers our students to be future competitors both nationally and internationally.

As always, together we will continue striving to provide the very best education for all South Carolina students.

Sincerely,

Barbara S. Nielsen

Barbara Stock Nielsen, Ed.D.
State Superintendent of Education

1429 SENATE STREET COLUMBIA, SOUTH CAROLINA 29201 (803) T-34-8492 FAX (803) 734-8624

Table of Contents

Acknowledgements 4

A Cause for Celebration — Look How Far We've Come 5

Introduction 9

How to Use Connecting *Learners: The South Carolina Educational Technology Plan* 12

A Scenario: Schools, Technology, and the State's Economy 13

Mission, Vision, and Beliefs 15

Technology Planning 16

Funding for Technology 29

Connecting Learners — Curriculum, Standards, and Technology 32

Connecting Teachers through Professional Development 38

Systems and Support 46

I. Hardware and Software 49
II. Connectivity/Network Design 55
III. Physical Design 65
IV. Technical Support and Systems Maintenance 68

Bibliography 73

Acknowledgements

The South Carolina Educational Technology *Plan*, released in 1995, was developed by the Educational Technology initiatives Committee and was chaired by Dr. Benny Coxton. Connecting Learners: The South *Carolina Educational Technology Plan* builds on the successes and expands on the vision of the original plan. We acknowledge the work of the educators, businesses, and citizens who created the blueprint that has brought South Carolina to the forefront in providing telecommunications access to all students in our state.

The South Carolina Department of Education gratefully acknowledges the public/private partnership that guides the K-12 Technology Initiative. This partnership includes the South Carolina Department of Education, the Office of Information Resources at the Budget and Control Board, South Carolina Educational Television, and our telecommunications providers - BellSouth and LightStar. In addition, we acknowledge the support of the Governor's Office and members of the State Legislature. We offer special thanks to Jon Beard, Amy Pritchett, and Lloyd Spruill of Productivity Point International, and Bill Thomas, Southern Regional Education Board, for their assistance with technology planning.

We also would like to acknowledge the committee members and staff members that carried the vision to create this updated version of the state's educational technology plan:

Ms. Martha Alewine, South Carolina Department of Education; Dr. David Altus, South Carolina Department of Education; Ms. Donna Ashmus, SouthEast and Islands Regional Technology in Education Consortium; Dr. Joan Assey, Richland County School District Two; Dr. Dan Barron, University of South Carolina; Ms. Linda Bartone, South Carolina Department of Education; Mr. Stan Bugner, GTE Service Corporation; Dr. Benny Coxton, Winthrop University; Ms. Tami Clyburn, South Carolina Department of Education; Mr. Marc Drews, South Carolina Department of Education; Ms. Christine Fisher, South Carolina Teacher of the Year, 1997; Mr. Thomas J. Fletcher, Office of Information Resources; Ms. Betty Jo Hall, McCormick Elementary School; Mr. Jim Hockman, Richland County School District One; Dr. Terry Holliday, Rock Hill School District Three; Mr. Bill Hopkins, South Carolina Educational Television Network; Ms. Fern Howell, Governor's Office; Ms. Carol Jaworski, BellSouth; Mr. Ted Lightle, Office of Information Resources; Ms. Jane Pearman, IKON; Dr. Robert Perkins, College of Charleston; Ms. Pamela Pritchett, BellSouth; Dr. Linda Reardon, Clemson University; Mr. Bob Reese, South Carolina Department of Education; Ms. LuAnne Smith, South Carolina Department of Education; Mr. Walt Taylor, Office of Information Resources; Dr. George Terry, University of South Carolina; Ms. Donna Teuber, Richland County School District One; Ms. Barbara Teusink, Lexington/Richland School District Five; Ms. Ida Thompson, Richland County School District One; Dr. Rod Welch, The Citadel; Mr. Joe Woodbury, J. Paul Truluck Elementary School; Ms. Paula Yohe, J.V. Martin Junior High School. We express our thanks to Patsy Towery, Midlands Technical College, for her assistance with editing this document, and to Richard McLendon, Office of Information Resources, for facilitating the committee meetings.

Barbara Stock Nielsen, Ed.D.
South Carolina State Superintendent of Education

A Cause for Celebration — Look How Far We've Come!

The K-12 Technology initiative continues to place South Carolina on the leading edge of deploying technology in classrooms. And there is more cause to celebrate as South Carolina continues to transform student learning through technology. South Carolina has been recognized as one of five states that provides telecommunications connections for 100% of its schools (*Computers and Classrooms: the Status of Technology in* U.S. Schools, Educational Testing Service,1 997).

Telecommunications Infrastructure

- Every K-12 school and public library (almost 1400 sites) has Internet connectivity. Thus, our students have access to resources from the Internet, public libraries, other schools, and the resources of the South Carolina Information Network (SCINET).

- The unique public/private partnership that guides the K-12 Technology Initiative is a model that can be emulated throughout state government and is serving as a model for other states throughout the nation. Partners include the South Carolina Department of Education, the Office of Information Resources at the Budget and Control Board (OIR), South Carolina Educational Television (SCETV), and private sector telecommunications companies - BellSouth and LightStar.

- Over thirty schools in South Carolina are participating in pilot projects using two-way video. These projects are providing resources to students in rural and less affluent areas of the state. Plans for technology for all levels of education include the integration of telecommunications, two-way video, and broadcast technology into a seamless source of information for students and teachers.

- The South Carolina State Library is coordinating DISCUS, South Carolina's Virtual Library, on behalf of public, academic, and school libraries in South Carolina. This project provides access to a wide range of information databases via the Internet.

Professional Development

- Thirteen South Carolina Department of Education Regional Technology Centers, equipped with multi-station, networked computer labs and staffed with technology specialists, provide professional development opportunities and technology support to educators around the state. These classes and workshops focus on a broad range of technologies and resources emphasizing the Internet, video, multimedia, and CD-ROM. Not only is instruction and support provided at the computer labs, these technology specialists also visit schools to conduct on-site professional development workshops, assist with local technology planning, and coordinate training with the Math and Science Hubs.

- Over 21,000 South Carolina educators have participated in professional development opportunities funded by the K-12 Technology initiative. These include a graduate-credit distance education course, recertification courses, workshops, and technical courses for school district technicians.

- South Carolina's universities are providing a portion of the training for teachers with the University of South Carolina offering *Taming the Information Technology Jungle* for beginning technology users. Clemson University also offers six model school sites where teachers and pre-service teachers can learn how to integrate technology into their classrooms every day.

- A National Science Foundation grant of $9.7 million established an infrastructure of thirteen regional hubs to improve the quality of science and mathematics education. The South Carolina Statewide Systemic Initiative (SSI) has been funded an additional $5.85 million to focus on the effective use of data and professional development using Internet-based technology.

Video Infrastructure

- South Carolina Educational Television (SCETV) has installed a satellite dish and three receivers in every school in the state. The 32-channel satellite system enables students to access a greater variety of instructional programming.

- Twenty-eight distance education learning centers (DELCs) operating across the state offer short distance learning courses for students and teachers. Programs are developed to meet the specific needs of the schools served by each center.

- South Carolina's institutions of higher education serve as models of effective distance education. The South Carolina Technical Education System's interactive video network is used by the sixteen technical colleges and the South Carolina State Board for Technical and Comprehensive Education. Other sites in the state with similar technology are eligible to use this network. Courses are offered to high schools at attractive cost savings.

- The Teacher Training Institute, a result of the partnership between the South Carolina Department of Education and South Carolina Educational Television, provides professional development opportunities for teachers statewide on the use of technology resources in math and science.

Administrative Infrastructure

- IBM awarded the South Carolina Department of Education an $875,000 grant to develop a Data Warehouse to enable the department to form an electronic data collection and analysts system District data on school assessment and budgets can be extracted and loaded into the warehouse and extensive quieries can be

submitted. Citizens, educators, and policymakers will be able to access up-to-date information on which to base decisions about education.

- South Carolina has won national attention as the first state to implement a cost management system in all districts and schools. This system, **In$ite**, tracks how federal, state, and local education dollars are spent at the state; district, and local levels. All of **In$ite's** financial data is available to the general public on the South Carolina Department of Education's web site. By providing this tool for budget planning, managing funds, and communicating with the public about school finance, districts are better able to set priorities and align spending with those priorities.

- Leading by example, the South Carolina Department of Education developed and implemented an Internet-based online instructional materials ordering and inventory system. Teacher EIA grant applications and district Technology Literacy Challenge Fund sub-grant applications are also available online.

- Recognizing the need for advanced administrative software, four major computer software packages will be provided to school districts: a Windows-based school administration system to replace Osiris; a curriculum management system that correlates academic standards with what educators are teaching; a facilities management system; and a special education system for tracking **IEPs** and federal and state reporting.

- Traffic on the South Carolina Department of Education's Internet web site has increased from an average of 15,000 visits per month to more than 150,000. Information available for educators, parents, students, and community members has nearly tripled, and a complete redesign of the site makes it easier to use.

- An improved telephone system and a redesigned Internet site make obtaining teacher certification information easier for educators across the state. The **Office** of Teacher Education, Certification, and Evaluation plans to expand online services to include web-based access to all required application forms, regulations, requirements, and updates on changes.

Funding

- More than $84 million has been spent during the past three years to establish the statewide telecommunications infrastructure and to provide hardware, software, and professional development opportunities to schools and districts. State appropriations for educational technology funding has increased from **$3,250,000** in 1995 to **$33,520,000** in 1998.

- Apple license tags with the slogan, Public *Education: A Great Investment,* exemplify creative strategies to raise additional funds for educational technology. For $54 South Carolina citizens can purchase this special plate, with $34 of the fee going to the school district where the car is registered or to a specific school designated by the purchaser. The remaining $20 of the fee is distributed among school districts based on an equity formula.

- School districts have leveraged a variety of funding sources - including grants, business partnerships, bond referenda, and local funding sources - to support the objectives of district and school technology plans.

Arriving at one goal
is the starting point of another.
John Dewey

Introduction

"To thrive in today's world and tomorrow's workplace, America's students must learn how to learn, learn how to think, and have a solid understanding of how technology works and what it can do. American schools must, therefore, provide students with the opportunity to combine the best of traditional learning with the unprecedented opportunities technology offers."

CEO Forum, 1997

The nation is challenged to assure that all students are technologically literate and equipped with the communication, math, science, reading, social studies, visual and performing arts, foreign language and critical thinking skills essential for enhancing learning and improving productivity and performance.

Technology plays a central role in education improvement. To be able to prosper in a global economy and to be competitive in the 21st century, our students must have the skills and knowledge to access and evaluate information successfully from anywhere in the world at anytime.

One issue readily accepted today is the need to integrate technology in the learning process. Workers with computer skills significantly out-earn workers without these skills; therefore, the economic gap between the information-skilled and the unskilled continues to grow.

In a society permeated by rapidly changing and growing technology, we also have an obligation to promote lifelong learning and to provide our students with the resources that such an environment requires. High school graduates are no longer expected just to memorize facts. They need to know how to locate and use information effectively and efficiently in order to solve complex problems.

Providing equitable access to information regardless of where one lives is a primary concern to educators. South Carolina's unique public/private partnership provides access to the South Carolina Information Network (SCINET) for all K-12 public schools and libraries, affording new learning opportunities for our students and citizens.

Schools and districts, along with the State, have three major technology components with a focus on student learning:

Instructional
Technical
Administrative

- Instructional software applications and appropriate hardware that support teaching and learning in the classroom, media center, and lab.
- State telecommunications backbone for voice, video, and data.
- Ongoing support and maintenance for school and district networks.
- State funded software for administrative functions, curriculum management, special education, and facilities management.
- Library media center management software.
- Online textbook ordering.
- Data warehouse.
- Teacher certification.

All three components are essential in providing learners with optimum learning experiences. Furthermore, as educators we have an obligation to the children in our state that includes providing for students:

- Access to technology on a daily basis for research, problem solving, and projects.

- Increased electronic world wide information access via e-mail and the Internet.

- Sharing of instructional resources placed over the Wide Area Network and through Internet and intranet connections.

- Real-time classroom interactive sessions on the Internet with experts in the field.

- Use of an intranet for faculty and staff to electronically share lesson plans, common concerns, interests, and needs.

- Use of projectors, overhead panels, and laserdiscs interfaced to computers in the classroom to promote and enhance the learning experience.

- A safe environment for using Internet resources. Establishing an Acceptable Use Policy supports responsible use of the Internet.

"...we know from research that if technology is used properly by teachers, we will see gains in academic achievement for all students, from those in special-needs classes to those in our most advanced classes. South Carolina is ready to meet this challenge, to move forward, and to provide our children with the best possible education."

Barbara Stock Nielsen, Ed.D.
State Superintendent of Education

A growing body of research shows that when "properly used, technology can enhance the achievement of all students, increase families' involvement in their children's schooling, improve teachers' skills and knowledge, and improve school administration and management" (Valdez, Gilbert). Researchers at SRI International and the Education Development Corporation who studied schools where technology is used extensively, identified seven important factors that contribute to their success:

- Technology initiatives should start with instructional goals.
- Technology must be linked to curricular goals and frameworks.
- Technology and the assessment system must be compatible.
- Teachers and technology must work together.
- Teachers require ongoing pedagogical and technological support.
- Community and parent involvement enhances the likelihood of success.
- Business plays an important role in technology and school reform.

Information Resources Council
http://www.state.sc.us/irc

With a vision to coordinate and maximize South Carolina's information technology resources, the South Carolina Information Resources Council was created in 1996. One of the goals of the Council is to assure that information/telecommunications technology is a tool and NOT a barrier to the achievement of the vision and goals for South Carolina.

"It has never been more important than it is today for our children to have information technologies available in their classrooms so that they can acquire high tech skills that will prepare them to take their places in the world-wide market.

South Carolina's economic growth and stability depend, in large part, on our ability to match the future labor market needs with a world-class workforce of highly competent laborers, technicians, and professionals for the 21st century."

David M. Beasley
Governor
State of South Carolina

South Carolina Department of Education
http://www.state.sc.us/sde/

How to Use Connecting Learners: The South Carolina Educational Technology Plan

- As a guide for educators, schools, and districts to develop personal and institutional technology plans that ensure the effective use of information technology to support student learning.
- As a description of South Carolina's intent to raise all performance indicators in education.
- As a constantly renewing resource for information technology applications in our public schools.

We present this plan in two formats, a print version and a web-based version, to reflect the rapidly changing world of learning and technology.

This print version provides recommendations and an overview of the information resources and tools that will enable each school and district to continue moving forward in the implementation of technology. To make this document more beneficial to users, web sites containing relevant information have been placed in the margins.

For the most current, accurate links, this plan is available on the South Carolina Department of Education's web site.

Vision is the art of seeing things invisible.
Jonathan Swift

A Scenario: Schools, Technology, and the State's Economy

The learning environment is tied to the real world, where educators, students, parents, and community--local and worldwide-are valued as important players.

Troy, Juanita, and Cheryl, three biology students whose parents earn their livings fishing for shrimp off the coast of South Carolina, decide to investigate what can be done to bolster the declining shrimp harvest in their area. Gathering in a research nook of the school's library media center one afternoon, they spend an hour tele-interviewing a natural resources expert from the state Wildlife and Marine Resources Department who is knowledgeable about shrimping in South Carolina.

This expert agrees to link the students electronically to documents outlining existing state plans and initiatives. They then begin info-grazing with their hand-held electronic devices. A user-friendly software program prompts them to pose clear questions. They ask for strategies that have proven effective elsewhere in the world where fishing is critical to the economy. Routed through a global electronic highway system, in moments they begin to note news stories, videos, and resources and download them into their computers for later review. In a matter of hours they have expert testimony, field data, and anecdotes from other fishing communities.

Thanks to the global information network, the three students are in constant communication with their classmates and transmit their data to their school's local area network (LAN) for review by their peers. At their classmates' suggestion via e-mail, Troy, Juanita, and Cheryl go to the docks and interview shrimpers on how they feel their harvests could be improved. Including digital still pictures and videos of the shrimpers' interviews, the shrimp beds, boats, and coastal area of South Carolina, they once again connect to their school's LAN and share their information with their fellow classmates

After the information is received, their classmates begin the editing process, incorporating computer-generated simulations using the computer editing suite available in the library media center. The three students return to school and download pictures of shrimp indigenous to South Carolina's waters from the South Carolina Department of Wildlife's Internet web page.

Online encyclopedias, general periodical databases, and CD-ROM references in their school library media center are used to expand the information the three students have already collected. These pictures, information, and videos are combined with the information from their tele-interviewing into a multimedia document. The students then go to the production area of the school and produce an informative presentation which is then distributed via SCETV satellite to other educational institutions and appropriate state agencies.

The following week a two-way video conference is scheduled to bring together interested students, experts in marine biology, and state legislators to discuss potential legislation to remedy barriers to the shrimp industry's survival. Troy, Juanita, and Cheryl have truly made a difference in South Carolina's and their families' economic future.

A mind stretched to a new idea,
never goes back
to its original dimensions.
Oliver Wendell Holmes

Mission, Vision, and Beliefs

Belief Statements

1. Student learning is the focus and goal for all technology applications in our schools.
2. Technology is a tool and a means to achieve specific goals - technology is not the goal nor the end to be achieved.
3. Every student must be assured equity of access to all available technologies regardless of circumstances.
4. Students must become information literate if they are to face the challenges and enjoy the opportunities of working and living in a global economy and society.
5. Students will become lifelong learners and active participants in our democratic society by effectively and critically using technology applications.
6. Professional development for current and pre-service educators in the use and integration of instructional technologies is essential for student achievement.
7. Truly collaborative partnerships with parents and businesses are essential for the use of instructional technology to have the impact on student learning envisioned by South Carolina.
8. We must break the cycle of illiteracy by working with families and communities in South Carolina using available technologies and forming collaborations with state agencies and educational institutions

The mission of the South Carolina State Department of Education is *to* provide *leadership and services to schools and communities to enable all students, regardless of circumstance, to achieve world class academic standards.*

Our vision is that the children of South Carolina will be proficient in the use of technology by focusing on building knowledge and becoming life long learners. No longer will classrooms be confined by time and space. Our children will truly be connected learners, sharing, exploring, and evaluating information through many forms of interactive technology. The result of learning in this technology connected classroom will be adults who successfully live, work, and raise families into and through the next century.

We believe that high standards for student achievement are the heart of education reform in South Carolina, driving the goals we set for learning and directing every other aspect of what we do to support teaching and learning in our classrooms. *Connecting Learners: The South Carolina Educational Technology Plan* sets high expectations for our students, educators, and educational systems.

We celebrate learning as a dynamic, stimulating, and empowering process that continues throughout our lives.

Technology Planning

Curriculum and pedagogy drive technology applications in South Carolina schools. Technology is not an answer waiting for a question. Rather, it is a tool and process by which educators can continue to help children learn better. To accomplish this, technology plans and revised updates must be developed in a process that involves the active participation of representatives from all levels of district and school personnel as well as parents, students, businesses, and other citizens.

National Center for Technology Planning
http://www.nctp.com/topics. html

While each district and school is unique, some general guidelines should be considered in the planning process. There are numerous resources for districts and schools involved in technology planning which can meet their particular needs at whatever level of planning or implementation they currently are working. These include templates, guides, and sample plans found on the Internet. For example, The Key *Elements of State Planning for Educational Technology,* provided by the Southern Regional Education Board, has been adapted for use by districts and schools and is found in this section.

National School Boards Association
http://www.nsba.org/sbot/toolkit/

Southern Regional Education Board
http://www.sreb.org/

A Framework to Help Schools and Districts to Chart Their Course in Technology Planning

Another planning tool for districts and schools is *Technology in American Schools: Seven Dimensions for Gauging Progress - A Policymaker's Guide.* This document serves as a framework that focuses on the "combination of essential conditions that make it highly probable that the school will be able to effectively use technology to add a high degree of value to student learning." The seven dimensions included in the framework are interdependent components of a system, and it is anticipated that the educational community, technology coordinators, policymakers, and researchers

Milken Exchange on Education Technology
Technology in American Schools: Seven Dimensions for Gauging Progress - A Policymaker's Guide
(full report)
http://www.milkenexchange.org

Education Technology
7 Dimensions of Progress

1. Learners
2. Learning Environments
3. Professional Capacity
4. System Capacity
5. Community Connections
6. Technology Capacity
7. Accountability

will use this framework as:

- A vision that will define expectations for the public investments in K-I 2 learning technology.
- A self-assessment tool that assists schools, districts, and states to gauge their own progress toward that vision.
- A planning tool for strategizing how to bring technology and telecommunications into their systems in ways which improve student learning.
- An accountability system for tracking the return on public investments in education technology.
- A research agenda that will help guide studies of how and under what conditions technology is an effective tool for learning.

Each dimension includes a list of the various questions the public, policymakers, educators, community members, and business and industry representatives should ask - and educators should answer - as technology and telecommunications are deployed in K-I 2 schools.

(Source: Milken Exchange on Education Technology, Technology *in American Schools: Seven Dimensions for Gauging Progress - A Policymaker's Guide)*

Technology Plan Checklist

To further assist schools and districts in technology planning, the following checklist has been developed to ensure that technology plans are comprehensive.

Evidence of school technology planning is indicated by:

- Strategies to use all information technologies to improve student learning.
- Instructional technology being used as a link to curricula and standards.

- Teachers using technology resources as instructional tools.
- Professional development opportunities for all faculty and staff members.
- An assessment plan that evaluates telecommunications services, hardware and software, and student results.
- A technology budget that is sufficient to acquire and maintain hardware and software and support professional development.
- An evaluation and/or revision process to enable the school to monitor progress and respond to new developments and opportunities.

We are now at a point that we must educate our children in what no one knew yesterday, and prepare our schools for what no one knows yet.
Margaret Mead

Evidence of district technology planning is indicated by:

- A technology vision that supports the integration of technology into the curriculum.
- The use of technology to reach defined educational goals.
- The identification of technology resources currently available and those budgeted for acquisition.
- Multi-year planning that spans more than one year.
- Descriptions of how technology supports student learning.
- Plans to support staff development that ensure effective use of technology.
- Assessment of the impact of the use of technology.

Good technology plans are vital to ensure that instructional benefits to students are maximized.

Recommendations

1. It is recommended that each school and district revise and/or update a comprehensive technology plan that is incorporated into the district strategic plan.
2. It is recommended that district and school technology readiness be included as a success indicator on the Education Accountability Act's annual report card.

The Key Elements of Effective District Planning for Educational Technology: A District Technology Plan Template

Adapted with permission from The Key Elements *of Effective* State *Planning for* Educational Technology, Southern Regional Education Board

Planning is critical if technology is to have a positive impact on education, but the job of technology planning is becoming more and more challenging. How can planners be effective in a constantly changing environment? You can expect to see changes in the technology industry and the education environment; therefore, to remain effective your plan must have the built-in flexibility to change with the complex environment in which it must function.

Throughout this planning guide, educational technology refers to any electronic and information technology used to support or aid teaching and learning. This might include, for example, a distance learning network, instructional courseware, or laserdisc players for classrooms.

Stage One: Preparing

The preparation for planning can be as important as planning itself. A major mistake is to start the planning process before all the major ingredients are in place. No ingredient is more critical than the strategic vision.

Strategic Vision: What is your vision, how will you achieve it, and how will you paint the picture for the school community?

Your ability to create a vision and communicate that vision to the public will be important. You must show the school community what education will look like after the technology is in place. You must describe to the public, in terms easily understood, the new educational environment that will result from the integration of technology and education. This is particularly important if you intend to use technology as a major component of a school restructuring effort.

Some of the more common questions you will hear from the public include:

- What will education look like?
- How will education change because of your plan?
- What will be different?
- How will the school environment change? (For example, what will the school day or year now involve?)
- How is technology going to affect the education of individual children?
- How will you measure student achievement?

- How will technology affect the role of teachers?
- How will stakeholders be affected?
- How will educational technology help improve education?
- How much will your plan cost, and is it worth the expense?
- How does the plan build on what already exists?
- What research exists to support the plan?
- How will you prove at some point in the future that you have done what you plan to do?

A good public relations campaign, including a strategic media plan, will help you achieve your vision. Public forums, such as local meetings and technology demonstrations, can be beneficial parts of this campaign. Activities at these meetings could differ according to the interests of the community involved.

Each time you share your vision of technology with the community, you will come one step closer to gaining support and understanding. As one state planner put it, "Support for the plan must begin with the grassroots."

Goals and Objectives: What do you hope to accomplish through the use of educational technology in your district?

One important task in the planning process is to clearly define your goals and objectives for educational technology. What you plan to accomplish will be limited by such factors as funding and human resources. You should consider these and other constraints when establishing your goals and objectives. Unrealistic promises can lead to doubts and a loss of support among your staff, teachers, local government, and the voting public. If clearly defined, your goals and objectives will drive your remaining planning decisions.

Consider the following questions when establishing goals and objectives: How will technology support your district's educational goals?

- What do you want the district educational technology plan to do?
- What can you realistically hope to accomplish?
- What are your short-term and long-term goals?
- What are your **instructional objectives?**
- What are your **administrative objectives?**

- How will you link instructional and administrative objectives?
- What is your evaluation plan?
- What are your staffing needs?

Technology is most effective when it is used to fulfill an educational need or objective. Goals and objectives need to be defined not only for the plan itself, but also for each of its sub-components. For example, as a sub-component of your plan, your professional development program will require a clear set of goals.

Closely tied to your goals and objectives will be the evaluation criteria used to measure whether established goals and objectives have been met. For this reason, it is important to begin planning for the evaluation process while you are defining your goals and objectives. Of primary consideration is how you will know that you have reached your objectives. The use of an independent third party can help lend credibility to the evaluation process. (The evaluation process is discussed more fully in Stage Three of this guide.)

Needs Assessment: What is your district's current status?

A review of your district's current educational and technology status may help you determine your needs and focus your planning efforts. There are several things to consider when assessing your needs. These are:

- The varying technological sophistication of the schools in your districts.
- The inventory of existing technologies and how they are being used.
- The ability and availability of staff to help you plan.
- The expertise of school district staff to plan for educational technology.
- The impact state laws and regulations may have on your educational technology plan.

It is important to remember that educational technology is more than computers. Many technologies, such as telecommunications technologies, satellite networks, videodisc players, and instructional television could meet your needs. Have you addressed all technologies?

Scope: What will your plan cover?

A clearly defined scope for the plan will help eliminate unrealistic expectations. It is helpful to define what the plan will, and will not, cover. Your answers to the following questions may help define your plan's scope:

- Will the plan cover both instructional and administrative technologies?

- What technologies are to be covered by the plan?
- Will you ask schools to draft their own technology plan? If so, will you provide them with guidelines for writing these plans?
- Should your plan define the technology standards for old as well as new facilities? How about old technologies?

Depending on your situation, it may be wise to plan simultaneously for instructional and administrative technologies, since these systems are becoming increasingly interdependent. For example, in an integrated system, these technologies can be used to efficiently produce accountability reports.

Defining Stakeholders: Who has a stake in educational technology planning?

The identification of stakeholders is a major consideration for the educational technology planner. Stakeholders are people who may benefit from or be impacted by your plan's success. Stakeholders can either be a great source of support or a roadblock to progress. Experts agree that there are three things to remember when dealing with stakeholders - identify, inform, and involve. When identifying stakeholders ask yourself:

- Who has the power to accept or reject the plan?
- Who can influence public acceptance of the plan?
- Who can help gain support for the plan?

There are many categories of stakeholders in a district. These may include: teachers, parents, local governing bodies, chambers of commerce, school board members, business leaders, special interest groups, students (K - adult), school administrators, school library media personnel, and associations.

Keeping stakeholders informed is critical to maintaining their support, whether you choose to communicate through meetings, newsletters, or personal correspondence. You may again find that a carefully planned public relations effort will be beneficial.

There are many ways to invite stakeholder participation. The level of involvement may depend on personal interests, time limitations, and technical expertise. Whether a stakeholder serves on an advisory group, co-chairs a task force, or prefers simply to be kept informed of your progress, you must capitalize on his or her individual strengths to gain broader support for the plan.

Organizational Structure: How will you organize those involved in the planning?

Educational technology planning can be a very complex task. You cannot plan in a vacuum, and you will need assistance. You must decide how best to manage and organize this assistance. There are many different alternatives: a large structure with several sub-committees and task groups or a small structure with one planning committee. For example, some districts have formed a task force made up of influential and respected citizens. Still others have established multiple advisory groups representing major stakeholders in the district to assist a core committee.

Different types of organizational structures have their merits. It is your challenge to choose the one that will be most effective and productive. When desighing an organizational structure you may want to consider:

- How will you gain stakeholder input?
- How will individuals be selected, and what will their responsibilities be?
- What are the tasks you want to carry out?
- How will the input of all those involved be brought together?

Funding: How and when will the plan be funded?

Funding is critical to the success of your plan. It is important to consider not only how the plan will be funded, but when it will be funded. Your plan will most likely progress in phases. Without the funding to complete each phase on time, the plan could be stalled and public support lessened. For this reason, it will be essential to determine the funding schedule.

Equity: How will you promote equity - both in planning for educational technology and integrating it into education in your district?

Equity is a critical consideration for the district educational technology planner. It can be defined in many ways, depending on your district's current status and objectives for education. You may, for example, define equity in terms of equal educational outcomes for students in your school district. You might also define it in terms of an equal distribution of technology funds. However it is defined, equity must be considered when planning.

Technology has the potential to promote equitable access and opportunity. For example, state networks can give all students access to the same resources, and distance learning can offer all students the opportunity to take the same classes. **Without** proper planning, however, investments in technology can further separate the *haves* and *have nots* in your district.

You may want to consider:

- How will funding be distributed?
- How will you help less advantaged schools plan for and use technology?
- Will you have to allocate additional staff time for assistance?
- Do you hope to establish a standard minimal technology base in all schools?
- What will you do about those schools that have already invested in technology?

Professional Development: What kinds of training considerations are needed for faculty and staff?

Staffs ability and willingness to use technology depends on their familiarity and level of comfort with it. Professional development implies more than training - it also refers to professional growth. The educational technology planner must carefully consider how best to train staff to use technology effectively and how to provide staff with the guidance they need to adjust to a changing educational environment. Experience has shown that many factors make this task difficult, including the lack of time, money, motivation, and the capacity to provide for ongoing technical assistance within the schools.

Teachers must not only know how to use various technologies but also must have a clear understanding of how technology changes the learning process. Professional development should be used to help teachers develop teaching strategies and to explore the impact technology will have on their teaching methods.

When planning for staffs professional growth, you will need to address the following questions:

- How can teachers be given the time they need to prepare to use technology?
- Is there a medium that encourages peer communication among staff in your district?
- How will technology impact education?
- How will the addition of technology change the way students are taught?

Experts offer the following suggestions to make training more effective:

- Train staff in their own building, on their own equipment, to meet their own needs.

- Plan for training to be continuous.

Administrators will need training as well. With the addition of new technologies, administrators will need to know the pros and cons of various technologies, how to determine whether desired learning outcomes have been reached, and how to use technology to run their buildings.

Vendors and Outside Consultants: How can you establish a beneficial relationship with vendors and consultants?

Vendors and consultants can help to ensure the success of your plan. However, before involving vendors and consultants in the planning process, decide what you want them to do. If beneficial relationships are established, vendors and consultants can be good sources of helpful information and advice, while ultimate planning decisions are made by the school district. Ask yourself these questions before involving vendors and consultants:

- How will you evaluate hardware, software, and staff development?
- How will you deal with maintenance and replacement issues?
- Are state contracts and procurement a good strategy for your district, or would local level procurement be better?
- Would volume purchasing reduce your costs?
- Would leasing some items be beneficial?

Stage Two: Writing

There is no one way to write a plan. It will require much time and effort. The plan will be your principle means of communicating educational technology goals to decision makers and the public. For this reason, it should be organized and clear. Diagrams and illustrations can be used to effectively explain complex concepts not commonly understood by the general public.

Experts have identified several key elements generally included in educational technology plans:

- **Vision:** The picture you will paint for the public. What will the classroom look like when technology has been introduced?
- **Mission Statement:** An outline of challenges and an explanation of intended actions.
- **Goals and Objectives:** An identification of your expectations.
- **Strategy:** A statement of how you plan to accomplish your goals and objectives.

- **Scope:** The limits of your plan.
- **Training and Staffing Requirements:** A description of the human resources and training necessary to successfully implement your plan.
- **Evaluation Criteria:** Tools and techniques for judging the success of your plan.
- **Technical Standards:** The minimum requirements for each technology to be purchased.
- **Cost Estimates:** A forecast of your plan's cost.
- **Timeline:** A schedule outlining the steps of the plan with timetables for completion.
- **Glossary of Terms:** Definitions of technical jargon.
- **Upgrading, Maintenance, and Obsolescence Strategies:** These strategies may be developed as a result of contract negotiations with vendors. For example, a replacement schedule forecasting anticipated replacements for outmoded hardware might be included.

Some additional sections that have been successfully added to some district plans include: *Answers to Frequently Asked Questions* and *A Directory of Contact Phone Numbers*.

Stage Three: Evaluating

Evaluation: How will you judge the effectiveness of your plan?

A regularly scheduled evaluation of the plan, at least every 12 months, can help you monitor successes and remain on target. To lend credibility to the evaluation, you may consider the use of an independent third-party reviewer. A major concern is the plan's ability to reach established objectives and goals. Given changes in the education environment and new technological developments, you may find it necessary to change your plan periodically. Thus, you may want to consider how changes to the plan can be made and who can make and authorize these changes.

As mentioned in Stage One of this guide, your evaluation criteria should be established simultaneously with your goals and objectives. This will help significantly when you begin measuring your plan's successes. Establishing evaluation criteria before evaluating the plan not only leads to a more accurate assessment of the plan's effectiveness but is also another way to achieve credibility with the public, since they will know up front what the plan is intended to achieve.

For your evaluation to be effective, you will need a way to collect the data and information that you need. You may, for example, want to collect status reports from each school. This will require a certain degree of organization and staff time. You must

plan accordingly.

An important product of any evaluation is learning under what conditions different technologies work best. This will be extremely helpful in planning professional development efforts and assisting districts in their planning efforts.

Summary: Tips from the Experts

The purpose of this document has been to guide the efforts of those involved in district educational technology planning. It has done its job if you were: forced to question the way you plan; stimulated to think of something you had not previously considered; or motivated to become more actively involved in educational technology planning in your district.

It is important to remember that technology needs to be in place before training can begin. If individuals are trained before equipment is installed, chances are the training could be forgotten.

Finally, educational technology planning experts offer the following advice:

- To further illustrate its potential, use technology to present your plan, but do not let technology become the focus of your presentation.
- Expect to make changes to your plan. Build in flexibility and be prepared to make many tradeoffs before reaching your objectives.
- Be creative when seeking solutions to problems.
- Consider all your options - not just the first or most apparent.
- Borrow from what has been done before. For example, review the plans of other districts and take advantage of commercially developed planning instruments.
- Plan for unexpected developments. Always be ready with a Plan B.
- Use graphics to illustrate concepts in your plan.
- Showcase and build upon your successes.
- Involve all stakeholders as appropriate.
- Plan with the future in mind. Rapid changes in the information industry may require you to incorporate a completely new technology into the plan.
- Use pilots only if you know you can be successful.
- Build training and funding into a realistic timeline.
- When beneficial seek partners from industry and higher education.

- Consider all sources of funding as resources for educational technology.
- Plan for maintenance and upgrading of obsolete equipment and materials.

Keeping higher education and industry involved in or aware of your plan can prove very helpful. This interaction could lead to collaborative efforts benefiting your district in the future. For example, working with colleges of education may help them better prepare future teachers to meet your expectations for teaching with technology.

Checklist: Does **your plan**

- Coincide with state educational goals, regulations, and Connecting Learners: *The South Carolina Educational Technology Plan?*
- Address the issue of state accountability requirements?
- State a means for using technology for student achievement and reports of progress?
- Address both instructional and administrative technology?
- Designate a central authority for its implementation and evaluation?
- Define the school and district roles in making the plan work?
- Include a professional training and development component?
- Have a mechanism built in for change?
- Show a link between your educational objectives and technology?
- Address equity?
- Address upgrades, obsolescence, and maintenance?
- Address the need for a technology facilitator/team in the schools?
- Allow for an ongoing review and reporting process?
- Establish a reasonable timeline and scope?

Funding for Technology

South Carolina has made great strides in integrating technology into all phases of the curriculum and providing equitable access to all members of the educational community. A major component for continuing this technology integration must be consideration of the monetary support necessary for maintaining the hardware, software, and professional development opportunities needed to keep current.

Realistic budgeting for technology is part of the district planning process. Clearly defined goals and measurable objectives help establish district funding priorities. Criteria for funding district initiatives should be flexible and subject to a constructive review process designed to aid districts in the planning and implementation stages. This process should ensure not only a sequential, orderly development of technology in the district and its schools but also the construction of the infrastructure at the school and district level to give all schools and libraries access to the state infrastructure.

South Carolina must maintain the global view of providing access for all students regardless of where they live and attend school. A good example of this is *DISCUS - South Carolina's* Virtual Library. It provides a common core of databases to schools, colleges, and public libraries statewide to ensure equity of access to information.

Building a technology-rich learning environment requires a statewide commitment from the school and district leadership, from the educators and students, and from the business and school communities. Funding for school technology is ongoing, and there are no simple funding solutions. There is a considerable amount of financial assistance available from federal, state, and private funding sources.

South Carolina education has strong support from various sectors for technology integration. From the first year line item technology funding of **$3,250,000** in FY95, state technology funding in South Carolina has grown to support the K-12 library/ technology infrastructure, technology professional development, and substantial flow-through funds to school districts for hardware, software, and professional development.

State Contracts for Leasing Computers

http://www.state.sc.us/mmo/contract/it/lpcindx.htm

Creative funding of the wide range of technology tools necessary to support student learning requires leveraging a variety of state, federal, and local funding sources to accomplish the established technology goals. Leasing computers is an option that provides school districts continuing access to up-to-date computers.

The Foundation Center Online
http://fdncenter.org/

Funding and Grants - Education Place
http://www.eduplace.com/techcentlgrantsl

Schools and districts should explore partnerships with businesses, the community served by the school, hardware/software companies, and local post-secondary institutions in order to secure additional funding and support for future technology implementation. Technology funding sources include district general funds, district funds earmarked for technology, private foundations, local bonds, and grants.

Apple License Plates
http://www.state.sc.us/sdelednewsl1998/pmsctag.htm

Apple license plates are among other initiatives that have provided funds for South Carolina's schools to purchase technology. Since October 1996, South Carolinians have purchased 6,967 apple license plates for their vehicles generating a total of $376,164 for districts (figures through June, 1998).

The United States Department of Education Office of Educational Technology
http://www.ed.gov/Technology/inititiv.html

The *Technology Literacy Challenge Fund* was announced in February 1996, and the United States Congress first appropriated funds for this five-year program in 1997. The program is intended to serve as a catalyst to ensure that all students are prepared to live and work in an increasingly technological society.

Twenty-five South Carolina school districts received first year Technology Literacy Challenge Fund competitive sub-grants in September 1997 from the **$2,466,995** allocation. Priority was given to school districts with the highest

percentages of children in poverty and with the greatest need for technology. Competitive sub-grants will be awarded to school districts in November 1998 from the second year **$4,851,964** South Carolina funding allocation.

The sub-grants provide financial assistance to school districts for a wide range of activities to strengthen instruction through the use of technology. They are designed to assist school districts in meeting the following national technology goals: (1) All teachers and library media specialists will have the training and support they need to help all students learn through computers and through the information superhighway. (2) All teachers and students will have modern computers in their classrooms. (3) Every classroom will be connected to the information superhighway. (4) Effective and engaging software and online learning resources will be an integral part of every school curriculum.

Funding is necessary to continue the support for the state backbone, to wire all classrooms in South Carolina, to provide at least five computers and accompanying peripherals per classroom, to continue technology professional development initiatives, to support educational television access and resources, and to support and increase interactive video projects.

Recommendations

1. It is recommended that the State Legislature provide funding for full implementation and ongoing support of *Connecting Learners: The South Carolina Educational Technology Plan.* Technology is an inevitable part of education because technology and information literacy are now survival skills.
2. It is recommended that all school districts use **In$ite** in order to best manage education dollars, establish spending priorities, and improve communications between schools and communities.

Connecting Learners — Curriculum, Standards, and Technology

Information Literacy

Today's world has been transformed by information technologies. Learning to use technology is only one facet of a student's education. More importantly, information literacy – the ability to use the information which the new technologies make available as well as the ability to use those technologies to communicate this information – is a critical learning experience. Students must acquire the skills and knowledge necessary for them to access, evaluate, and use information efficiently and effectively.

ALA Information Power Table of Contents
http://www.ala.org/aasl/ip_toc.html

New national guidelines for information literacy, *Information* Literacy Standards for Student Learning developed jointly by the American Association of School Librarians (AASL) and the Association for Educational and Communications Technology (AECT), address this issue.

Derived from research and professional literature, the *Information Literacy Standards for Student Learning* are integral to the content and objectives of the school's curriculum. The standards profile the information literate high school graduate. This graduate has the ability to use information to acquire both core and advanced knowledge and to become an independent, lifelong learner who contributes responsibly and productively to the learning community.

National Educational Standards for All Students

NETS
http://cnets.iste.org/

The International Society for Technology in Education (ISTE) is developing national standards for the educational uses of technology to support PreK-12 education. ISTE's National Educational Standards for All Students project (NETS) is developing and refining four doucuments:

- *Technology Foundation Standards for Students* describes what PreK-12 students should know about technology and what they should be able to do with technology.

Learning Connection: Resources
http://www.benton.org/Library/School/res_home.html

- *Standards for Using Technology in Learning and Teaching* describes how technology should be used throughout the curriculum for teaching, learning, and instructional management.
- *Educational Technology Support Standards* describes systems, access, staff development, and support services essential to support effective use of technology.
- *Standards for Student Assessment and Evaluation of Technology Use* describes means of assessing student progress and evaluating the use of technology in learning and teaching.

The proposed technology foundation standards for students are divided into six broad categories:

Educational Technology Integration: Basic Technology Tools for Educators
http://www.sun-associates.com/resources/categories/bastools.html#anchor88822

1. Basic operations and concepts
2. Social, ethical, and human issues
3. Technology productivity tools
4. Technology communications tools
5. Technology research tools
6. Technology problem-solving and decision-making tools

Standards within each category as well as profiles will serve as guidelines for planning activities that integrate technology into the curriculum.

Connecting to Frameworks, Grade Specific Standards and Assessments

South Carolina Curriculum Frameworks
http://ww.state.sc.us/sde/educator/crindex. htm

NAEP
http://nces.ed.gov/naep/

TIMSS
http://nces.ed.gov/TIMSS/

As understanding of the process of learning increases, it becomes apparent that the appropriate application of technology can help students meet increasingly challenging standards. In South Carolina, educators have consistently created high expectations for all students, teachers, and educational systems. The South Carolina curriculum frameworks and curriculum standards in mathematics, science, English language arts, foreign language, visual and performing arts, and social studies are correlated to world-class standards supported by the National Assessment of Education Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS).

New strategies and opportunities

Web Sites with Strategies, Projects, Ideas

Blue Web'n
http://
www.kn.pacbell.
corn/wired/
bluewebn/
index.html

Jason Project
http://
www.jasonproject.
org/

The Gateway to Educational Materials
http://
www.thegateway.
org/

Teachers continue to review and expand their teaching strategies by using authentic assessment, collaborative learning groups, and discovery learning. Technology offers teaching and learning opportunities never before possible. These opportunities include:

- Students having daily access to information in a variety of formats for research, problem solving, and projects.
- Sharing of instructional resources through the use of Wide Area Network and Internet connections.
- Real-time classroom interactive sessions such as virtual field trips and online discussions.
- Use of an intranet for faculty and staff to share electronically curriculum and lesson plans, common concerns, interests, and needs.
- Expanding learning opportunities via distance-education.
- Providing special-needs students with telecommunications, sensory, and other technological aides and devices.
- Including parents and community members in programs using educational technology.

Changing Roles

Learning With Technology Profile Tool
http://
www.ncrtec.org/
capacity/profile/
profwww. htm

Teachers who use technology effectively as an instructional tool shift from a traditional lecture, two-person situation (teacher-student) to a project based, three-person situation (teacher-student-others) where students are learning from each other as well as from outside experts.

Research on learning styles indicates that effective combinations of information technology can help learners succeed (Benton Foundation, Bialo and Sivin-Kachala, Means, National Study of School Evaluation, Office of Educational Research and Improvement). How those technologies are effectively combined by the teacher and how the learner is helped to use them are fundamental to success. Students must be actively engaged in real world learning situations through challenging, collaborative tasks Applying technology appropriately to a standardsdnven cumculum will improve students' academic achievement while instilling the desire to learn.

Askeric Toolbox

http://ericir.syr.edu/Qa/Toolbox/#EDTECH

To integrate technology into instruction, teachers must rethink their teaching strategies to enhance student learning and collaboration. For example, cooperative learning allows students to be explorers, building on the diversity of students' prior knowledge. Students. are grouped into teams of two or more, and each team has the responsibility to accomplish objectives to meet the overall goal.

Even if a teacher has limited access to technology tools, such as only one video camera or computer, there are numerous ways to use these tools to engage students effectively in learning. Strategies to use when access to the computer (or other technology tool) is limited include:

Kathy Schrock's Guide for Educators
http://www.capecod.net/schrockguide/index.htm

- Creating a schedule when small teams may use the computer.
- Enlisting volunteers to assist students when working on the computer.

The One Computer Classroom
http://www.chtree.com/per/Frank/edt61 0/henderson/wq/onecomputer.html

- Ensuring that the resources on the computer are age-appropriate and at the appropriate reading level so that assistance needs are minimal.
- Training student experts to help with specific questions.
- Pairing students so that peer-tutoring can take place.

Resources for Educators

South Carolina Instructional Television
http://www.ITV.scetv.org/

In addition to supporting new approaches to learning, information technology also increases the teacher's access to professional resources. The Internet provides teachers with access to best practices, curriculum resources, lesson plans, instructional strategies, and collaborative projects. A myriad of resources is available from the South Carolina Department of Education's Instructional Television (ITV). For example, the ITV Searchable Database on CD-ROM provides educators with full text teacher guides and schedules for ITV programming.

The Role of the Media Specialist
http://
www.ala.org/aasl/
positions/
PS_flexible. html

The school library media specialist is a valuable resource who can help teachers and students in every area of information technology applications. From finding information in a wide variety of formats in the media center or on the Web, to evaluating the information critically, to communicating the analyzed and synthesized information, the media specialist is a partner with classroom teachers, administrators, and other staff members. The South Carolina Department of Education's publication *Making Connections: Focus on South Carolina School Library Media Programs* is designed to assist media specialists, schools, and districts in planning and administering school library media programs that reflect the changing and expanded roles of the media specialist.

Technology and Assessment

Assessment and Accountability Bibliographies
http://
www.nwrel.org/
eval/ea_bibs/

As educators expand their application of technology in classroom instruction, they also follow the logical process of using technology as a tool to assess that instruction. Using technology as a tool for assessment offers a number of advantages including easy scoring and immediate feedback for teachers and students, flexibility in administering tests and quizzes, and testing that adapts to the individual student. Computer-based assessment also provides more effective record keeping and extensive item analysis which produce quicker and more helpful student feedback.

Ask Dr. Rubric
http://
cep.cl.k12.md.us/
drr/drrhome.html

Computer software programs manage information on a scale never before imagined. Computer-based simulations offer real world experiences promoting higher level thinking and problem solving. The wide variety of products that provide evidence of student achievement may be organized into electronic files, including images and sound, that are easily accessible and require little physical storage space.

As an administrative tool which can bring efficiency to the management and assessment realms of education, technology-based assessment addresses the same issues of accuracy, confidentiality, and validity as traditional methods:

- Assessment should be fair, not culturally or otherwise biased.
- Assessment must be valid; it should measure what it is

supposed to measure.

- Assessment must be reliable, producing consistent, repeatable results.
- Assessment should be cost-effective in terms of labor, materials, and time for both administrators of the assessment and the students being assessed.
- Assessment results must be kept confidential and used only by those who have the right to access them.

Educational Testing Service
http://www.ets.org/body.html

Recommendations

1. It is recommended that each school and district adopt the national information literacy standards for student learning and integrate these standards into the content areas of the curriculum.

2. It is recommended that each school and district adopt the ISTE National Educational Technology Standards for students.

3. It is recommended that each school and district include technology in the delivery of instruction and student assessment in all content areas.

Develop a passion for learning.
If you do, you will never cease to grow.
Anthony J. D'Angelo
The College Blue Book

Connecting Teachers through Professional Development

"Districts need to provide more and better training for teachers. The first phase of our training was familiarizing them with the basics of using a computer. Now we're concentrating on helping teachers use computers and other technology in ways that bring classroom lessons to life -that integrate technology into the teaching and learning process."

Barbara Stock Nielsen, Ed.D.
State Superintendent of Education

For students to benefit fully from all they learn about information technology applications, they must have teachers who understand how to integrate those technologies into the curriculum. To accomplish this fundamental goal, a determined effort to work together by the South Carolina Department of Education, South Carolina Educational Television, all institutions of higher education, as well as schools and school districts and their business partners is essential. Professional development available at the local level to provide enhanced opportunities for information technology application is the key to success.

Initially, a major effort must be made to reach all educators who are currently employed in South Carolina schools. A major step in this direction is the South Carolina System for Assisting, Developing, and Evaluating Professional Teaching (ADEPT), an integrated system of state standards, guidelines, and strategies designed to promote excellence in the teaching profession. These standards provide the foundation and continuity for all of the stages of teacher development.

ADEPT
http://www.state.sc.us/sde/reports/adept. htm

At the same time, all teacher preparation programs must be encouraged to integrate information technology applications into their curricula and to assure that graduates of these programs have the knowledge and skills recommended in this technology plan. Because of constant changes which are inherent in information technology use, the essential core competencies require ongoing renewal.

Regional Technology Centers
http://Pathways.sde.state.sc.us/regional/

The South Carolina Department of Education's Regional Technology Centers are essential to the professional development initiative. The ongoing support of these centers in providing dynamic continuing education courses is available to all educators in the state.

Technology and Teacher Education
http://
www.mcrel.org/
connect/tech/
prodev.html

Professional development is essential in order for teachers, administrators, and support staff to observe and learn about the variety of educational uses technology has in the classroom. Educators must be given the tools to learn how to organize and effectively manage students in technology based school environments.

ISTE Recommended Foundations in Technology for All Teachers

ISTE
http://www.iste.org/

The following competencies for all educators have been developed by the International Society for Technology in Education (ISTE) and adopted by the National Council for the Accreditation of Teacher Education (NCATE). These competencies also reflect standards in the documents used by the Southern Association of Colleges and Schools (SACS) as guidelines for accreditation developed by the National Study of School Evaluation (NSSE).

Basic Computer/Technology Operations and Concepts

All educators should be able to:

Healthy Computer Page
http://
pip.ehhs.cmich.edu
/healthy//

- Operate a multimedia computer system with related peripheral devices; successfully install and use a variety of software packages.
- Use terminology related to computers and technology appropriately in written and oral communications.
- Describe and implement basic troubleshooting techniques for multimedia computer systems with related peripheral devices.
- Use imaging devices such as scanners, digital cameras, and/or video cameras with computer systems and software.
- Demonstrate knowledge of computers and technology in business, industry, and society.

Personal and Professional Use of Technology

K-12 and Beyond Resources
http://carbon.cudenver.edu/public/education/k12/SurvivalKit.html

National Center to Improve Practice in Special Education through Technology, Media, and Materials
http://www.edc.org/FSC/NCIP/

All educators should be able to:

- Use productivity tools for word processing, database management, and spreadsheet applications.
- Apply productivity tools for. creating multimedia presentations.
- Use computer-based technologies including telecommunications to access information and enhance personal and professional productivity.
- Use computers to support problem solving, data collection, information management, communications, presentations, and decision making.
- Demonstrate awareness of resources for adaptive assistive devices for students with special needs.
- Demonstrate knowledge of equity, ethics, and human issues concerning the use of computers and technology.
- Identify computer and related technology resources for facilitating lifelong learning as well as the developing roles of the student and the educator.
- Observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distance learning applications.

Applications of Technology in Instruction

EvaluTech
http://www.evalutech.sreb.org/

California Clearinghouse On-line
http://clearinghouse.k12.ca.us/

The Copyright Web Site
http://www.libsci.sc.edu/scasl/scasl.htm

All educators should be able to:

- Explore, evaluate, and use technology resources including applications, tools, educational software, and associated documentation.
- Describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum.
- Design, deliver, and assess student learning activities that integrate computers/technology into a variety of student group strategies and diverse student populations.
- Design student learning activities that foster equitable, ethical, and legal use of technology.
- Practice responsible, ethical, and legal use of technology, information and software resources.

Competencies for Advanced Programs
http://www.iste.org/Resources/Projects/TechStandards/

The competencies suggested for educators in specialized areas of information technology application are also those developed by ISTE for advanced programs. Those suggested guidelines and standards have been developed by the Association for Educational Communications and Technology (AECT) and the American Association of School Librarians (AASL).

Roles and Responsibilities

Many organizations at the local, regional, and state levels are responsible for implementing professional development needs for teachers, administrators, and staff.

Schools

Technology and Teacher Education
http://www.mcrel.org/connect/tech/prodev.html

Regular ongoing professional development for faculty and staff should be encouraged and supported daily. Initial education and training or follow-up activities which reinforce and extend workshops or courses provided by other agencies or institutions should be sustained. The sooner educators learn to use local resources, the sooner these technologies will be integrated into the basic curriculum.

Strategies for schools include:

South Carolina Association of School Librarians
http://www.libsci.sc.edu/scasl/scasl.htm

- Providing faculty and staff with opportunities for professional development during the school day as well as other times.
- Providing faculty and staff with appropriate support from the school library media programs and media specialists.
- Providing on-site mentoring.

School Districts

Because technology is constantly changing, there is a continual need for classroom teachers and other professional staff to acquire knowledge and skills. K-12 school districts should incorporate in-service training days within their annual calendars. These in-service days should include specific activities to update the skills of teachers in the applications of technology for learning

Strategies for school districts include:

Professional Development: the Challenge Ahead
http://www.thejournal.com/special/profdev.html

- Providing in-service workshops for administrators in technology planning and using technology in curriculum instruction.
- Providing access to technology instruction in order that all teachers can achieve the competencies listed in this plan.
- Providing in-service workshops modeling the use of technology by exemplary teachers.
- Offering in-service workshops at a variety of times to meet the varying schedules of teachers.
- Offering in-service workshops at varying knowledge and skill levels.
- Supporting all schools in integrating technology into the curricula.

The Ten Best Web Sites for Educational Technology
http://www.fromnowon.org/techtopten.html

Higher Education

Technology-Savvy Education Schools
http://www.scholastic.com/el/exclusive/exceptions496.htm

Higher education is directly involved with teacher education at pre-service and in-service levels. As such, higher education partnerships are a critical component of the professional development effort.

Effective Technology Use in Pre-service Education
http://www.ncrel.org/sdrs/highered/hefront.htm

Pre-service: Higher education institutions must provide their students with the knowledge and skills listed in this technology plan's competency section. All candidates for initial certification should demonstrate that they meet the competencies through courses or other appropriate documentation before they are certified. Courses to meet this requirement should be available from NCATE accredited state colleges and universities that provide initial teacher certification.

In-service: Institutions of higher learning must provide course work for academic credit or continuing education/re-certification credit at the undergraduate or graduate levels based on the career objectives of the individual educator. These should include introductory and advanced information technology applications for learning.

Professional Development Opportunities
http://www.libsci.sc.edu/miller/Professional.htm

Strategies for institutions of higher education include:

- Providing all students in education career programs with beginner-level proficiency in technology applications for learning.
- Collaborating among themselves to assure statewide access to courses and workshops in information technology.
- Continuing to collaborate with appropriate local and state agencies to provide academic and continuing education credits.
- Modeling information technology integration into all higher education courses and programs.
- Offering a variety of courses in information technology that reflects its changing and dynamic nature.
- Offering courses to all interested teachers using the full range of available technologies at locations and times which are convenient and appropriate.

"We have been placing new technology at the disposal of our students and teachers at a very rapid rate, but we have also been working aggressively to train our teachers in the effective use of technology."

Barbara Stock Nielsen, Ed.D.
State Superintendent of Education

The South Carolina Department of Education

Because of its wide access to the state's school districts, the South Carolina Department of Education will provide leadership for all levels of professional development.

Strategies for the South Carolina Department of Education include:

- Providing professional development, planning, and support to foster local school district technology development through the Regional Technology Centers.
- Incorporating the competencies listed in this plan into the rules, regulations, standards, and assessment requirements of the Department of Education's Offices of Assessment, Teacher Licensure and Certification, and Professional Development.
- Developing guidelines for integrating information technology into the state curriculum standards with specific examples of teacher activities.

Organizations that Support Professional Development

Just as information technology must become an integral part of the curriculum, it should be an integral concern for each of the state's professional associations. While certain organizations have greater focus on technology applications for learning than others, all should work collaboratively to ensure the broadest possible network of learning and support. For example, the South Carolina School Boards Association assists school districts with such issues as establishing technology policies, strategic planning, and training personnel to effectively track budgets using In$ite.

South Carolina School Boards Association
http://www.scsba.org/

Strategies for professional organizations include:

- Sponsoring workshops and conferences across the state to help increase competency levels of teachers, administrators, and higher education faculty.
- Working collaboratively on conferences in order to bring together expertise which individual organizations may not be able to provide.
- Serving as advocates for all students to have access to technology resources in all classrooms.

Links to Professional Organizations
http://www.libsci.sc.edu/scasl/scasl.htm

Parent and Community Organizations

As local schools establish close working relationships with parents and community organizations, it is important that they be knowledgeable contributors to information technology applications in schools. Likewise local business partners should be given the same opportunity.

Strategies for parent and community organizations include:

- Collaborating with schools and professional associations to sponsor local and statewide workshops to inform members of information technology applications to learning.

Organization Links of Interest to Parents and Other Child Advocates
http://www.pta.org/links/OrgLinks.htm

- Sharing unique expertise with educators and schools.
- Supporting the efforts of local schools to achieve equity of access to the full range of technologies available for learning.

White local autonomy and independent goal setting are vital in the education system, collaboration among these various entities is critical to the overall success of professional development in South Carolina's schools.

Recommendation

It is recommended that all educators and pre-service teachers be provided with ongoing, high quality professional development so that they will have operating knowledge about hardware and software as well as pedagogical skills in the use of technology in support of curricula.

We must always change, renew, rejuvenate ourselves;
otherwise, we harden.

Goethe

Systems and Support

As part of developing a technology plan, each school district must initially assess their specific needs and curricula to determine the type of system best suited to meet the learning goals established in the schools in the district. In making this determination, school districts will have to address issues such as procurement, maintenance, support, administration, hardware and software resources, networking, and updating. South Carolina's school districts are keeping an accurate quantitative inventory of technology hardware resources by using the South Carolina Department of Education's online survey.

Survey Web Site
http://www.sde/educator/siteform. htm

In recognition of the rapid rate of change associated with technology, this section addresses these issues in general terms with hyperlinks to web-based resources and current technical data. Most technical terms are defined within this document, and web-based glossaries offer further explanation. Issues to be considered for systems and support design are divided into four main categories:

Terms and Definitions
http://
www.pcwcbodpedia.com

I. **Hardware and Software** - Includes information about standards; ratios; placement of hardware and software in classrooms, labs, media centers, offices and buildings; software; copyright; virus protection; and workstation security.

II. **Connectivity/Network Design** - Includes information about local area networks; workstations; servers; network operating systems; backups; cabling; widearea networks; e-mail servers; and security.

III. **Physical Design** - Includes information about issues such as electricity, lighting, and furniture.

IV. **Technical Support and Systems Maintenance** - Includes information about human resources and tools to maintain operational systems, maintaining hardware, obsolescensce, and upgrades.

Sources of Input for Streamlining Systems and Support'

School districts have access to numerous resources to obtain information, assistance, and guidance in making technology-based decisions.

Vendors and Suppliers - Maintaining an on-going dialogue with representatives from your suppliers and vendors will provide a valuable education. Reputable vendors stay in business because of their ability to assist customers in the process of defining applications, reviewing choices, and evaluating solutions. Many vendors provide web pages, newsletters, and seminars. They can be a valuable source of information and insight into today's market and trends.

Seminars/Continuing Education - These resources may be provided by vendors as well as consultants and educational institutions. While attending such an event, other colleagues are available for networking information and comparing solutions.

On-site Visits to Other Sites - Some schools, districts, and members of the public and private sector may be willing to provide observation training which shows off the quality of their hardware and software choices. Target recognized leaders and seek to learn from their examples. Establish an internal benchmark for where you are now compared to where you want to be in the future. Look for successful implementations, compare solutions, and discover why some are more successful than others.

Trade Press - A great deal of information is available from trade journals and professional publications. Some are now available via the Internet as well as through traditional print sources. Keeping abreast of new products and applications will enhance your ability to provide quality service to your customers, the students.

'Gartner Group/Datapro 'Best of Breed and Best Practices", August 20. 1997.

National Benchmarks

According to the 1997 School Technology Readiness (STaR) Chart', some national benchmarks have been established for maintenance in low tech, mid tech, and high tech environments. Their findings are as follows:

CEO Forum STaR Chart
http://
www.ceoforum.org/welcome.html

Low Tech- Generally an environment of outdated classroom computers with maintenance performed off-site on an irregular basis.

Mid Tech- Generally a mix of outdated and multimedia computers with maintenance performed off-site on an irregular basis.

High Tech- Generally, a mostly multimedia computer environment with off-site, regular maintenance.

Target *Tech-* almost all multimedia computers with on-site continual maintenance.

The STaR Chart is a tool that provides information that districts and schools can use to determine their current profile and assess their progress in using educational technology.

Recommendations

1. It is recommended that each school district move toward full implementation of the technologies specified in the Systems and Support section of this plan which includes a minimum of five computers per classroom and two-way audio/video capabilities in each school.

2. It is recommended that each school district utilize best practices in establishing policies for systems management, procurement, and support.

[3]CEO Forum on Education & Technology *School Technology and Readiness Report From Pillars to Progress - Year One. 1997.*

I. Hardware and Software

Standards

Examples of Standards Definitions

http://www.odu.edu/~occs/standards/standard.htm

http://www.okc.cc.ok.us/~jrichardson/my_stuff/minimum.html

It is important to establish and maintain standard system specifications for hardware and software. These standards should be defined based on your instructional program needs. They should be updated a minimum of once per year to reflect changes in available technologies. Having consistent standards will save your district considerable time and money for training and support. In addition, teachers and other staff members will be better able to assist one another and share data and resources much more readily with common applications and platforms.

Regular Classrooms (K-12)

Examples of Ratios Definitions:
http://www.ceoforum.org

It is recommended that each classroom contain a teacher workstation and at least five student workstations. These computers will be networked to enable in-classroom printing and classroom-wide viewing/display. It is essential that classroom workstations be connected to the building local area network as well as the district wide area network.

Technology in Special Education
http://home.earthlink.net/~thecatalyst/

The inclusion of technological tools in and throughout each school classroom for instructional enhancement and student learning is a priority of this plan. For example, the specific technological requirements of courses in the visual and performing arts and assistive technologies for special education students should be addressed by each school district.

General Hardware/ Software Purchase Information
http://www.cnet.com/

It is also recognized that technological changes leading to rapid hardware obsolescence, professional development requirements, and funding source availability will require an effective phase-in of these tools at a pace that parallels industry trends, instructional staff readiness, and resource availability. Telephones in classrooms will provide an added measure of security in addition to enabling students and teachers to participate in teleconferences and other interactive learning opportunities. The standard student workstation configuration for schools will be the same general configuration as the teacher workstation, including stereo

Current SC State IT Contracts
http://www.state.sc.us/mmo/contracts/itsclist.htm

Hardware Reviews and Sources

http://www.applicationsguide.com/

http://www.techweb.com/shopper

http://www.erols.com/chare/hardware.htm

http://www.zdnet.com/

http://www.reviewfinder.com/O/O.htm

Basic Classroom Components

- One teacher workstation
- Five student workstations
- One large-screen television monitor/receiver (35")
- One networked color printer
- One telephone

Computer Labs

It is recommended that each school (K-12) consider the use of computer labs appropriate to the size of the student population and instructional program. These labs will be utilized for keyboarding instruction, word processing, media production, project development, and other instructionally specific applications. As students progress to higher grade levels, labs will be increasingly used for more specialized instruction.

Basic Computer Lab Components

- One teacher workstation
- Twenty-five student workstations
- One large-screen television monitor/receiver (35") or projection device (LCD projector or LCD panel)
- One networked laser printer
- One networked color printer
- One telephone and regular business phone line

Specialized Computer Lab Components
(May be needed, depending on course requirements)

- One networked graphics/CAD compatible plotter
- One stereo amplifier, audio tape deck, and appropriate speakers (integrated with teacher workstations)
- One closed circuit video microscopy system
- Five spectrophotometers
- Five OHAUS Electronic Balances
- Five General Purpose Probes

Media Centers

It is essential that school library media centers incorporate today's technology and automation services as we prepare students for lifelong learning and develop their ability to access, evaluate, and use information. Automation of a media center incorporates the functions of an online public access catalog, circulation, inventory, and reporting.

A school and/or district-wide media automation application should:

- Provide for such media center activities as on-line catalog, circulation, search, checkout, interlibrary loans, and inventory.
- Be customizable per school building and be capable of providing a hierarchical view of various buildings and district collections.
- Include all necessary hardware and software to provide online catalog, circulation, search, checkout, and inventory throughout each school building.
- Be fully integrated with each building's local area network as well as the district wide area network and the state network.

Basic Media Center Components

- Automation software package
- One circulation (checkout) station per **300** students equipped with appropriate barcode reader/scanning device dedicated to resource reservation and checkout
- One student catalog and research station per 100 students
- One student creativity station per 300 students which includes:
  - One workstation
  - One color printer
  - One large screen television monitor/receiver (35")
  - One projection device (LCD projector or LCD panel)
  - One level III laserdisc player
  - One camcorder
  - One color flatbed scanner
  - One color digital camera

Trends, Product Reviews, and Articles Regarding IT Sorted by Industry, Including Education
http://
www.pubs.cmpnet.com/
internetwk/

Interviews and Reviews of Products and Trends
http://
www.realcomputing.com/

Magazine Reviews of Products
http://www.zdnet.com/
findit/mags.html

Administrative Resources and Non-classroom Locations

It is recommended that each administrative employee in the school be provided with a networked computer workstation equipped comparably to student workstations. At least one laser printer and five color inkjet printers (for administrative and supportive functions) is recommended for each 300 students attending the school.

Basic Administrative Components

- One networked workstation per administrator or support staff person
- One color inkjet printer per **60** students
- One laser printer per 300 students

Building Wide Resources

Each school building local area network should include appropriate components. The following listing is intended to be used as a general guideline. Specialized applications or directed processes may warrant inclusion of additional components.

Basic Building Components

- One building file server able to support all administrative and classroom computers
- One CD-ROM tower
- One networked postscript capable laser printer
- One flat-bed color scanner
- One projection device/panel for each 300 students for use in various areas of the school
- Fax capability

Software

Technology can be used to support specific skills and to foster creativity in the classroom, as well as to facilitate information access and use. Resources can be used to support whole class, small group, or individual instruction. Regardless of grade level, multimedia programs are available to be used for construction and presentation of student projects to include sound and video, which can be captured from multiple media such as video tapes, CD-ROMs, video disks, television, and the Internet.

The Internet can be used extensively in all classrooms at all grade levels. With connections to the Internet, students can work alone or in groups on various projects. They can begin researching a project by electronically checking to see what books are in their own school library media centers, other district libraries, the public library, the university libraries; by asking questions on some electronic discussion lists; and by browsing Internet sites to locate pictures, maps, graphics, movie clips, and other information specific to their project.

Choosing School Software
http://www.siec.k12.in.us/~west/article/soft.htm

Multimedia CD-ROM resources and software packages present databases of hundreds of types of statistical information regarding people, counties, demographics, and economics. These resources serve as interactive research tools offering much more than a textbook. Most programs have extensive multimedia components which offer full motion video, sound, still images, as well as comprehensive text. Students can use these resources for projects based on classroom instruction or for individual/group projects. Students can also create their own databases for presentation of information they have discovered for projects and other assignments.

Software in the Media Center

A common library automation package throughout the district will enable students and teachers to use the application effectively as well as provide training to library media specialists and staff on a district basis. In addition, district purchase of online resources can provide for reduced costs

on purchases as well as district wide training.

Software in Administrative Offices

Software Reviews
http://
www.evalutech.sreb.org/

http://www.benchin.com/

http://www.ucc.uconn.edu/
~wwwpsce/wccol.html

http://
www.worldvillage.com/wv/
school/html/schoirev.htm

A state supported administrative package for attendance, scheduling, and other school administrative applications provides the ability to transfer data throughout the district and deliver state wide training.

Instructional Software

Allowing teachers to have input into the purchase of instructional software will help ensure the effective use of the software. Demonstrations from vendors to groups of teachers encourages the interchange of ideas and additional uses of the materials. A district wide purchase usually results in reduced costs and training.

Choosing a standard application suite for word processing, database, and spreadsheet package allows for district wide training and provides the staff the ability to share information and tips on using the packages and to brainstorm for additional uses of the software.

Copyright

Copyright Issues
http://www.ala.org/library/
fact16.html

http://www.ala.org/library/
fact07. html

http://www.benedict.com/
fund.htm

One major issue of concern to all educators in using computer software is the copyright law governing its use. All educators should strive to set an example for students by obeying the copyright laws. Each school district should have a copyright policy concerning the use of all copyrighted material.

Anti-Virus:

As schools go online, risks of damage to computers by electronic viruses increase substantially. The likelihood of encountering a virus has increased sharply over the last year. Downtime and lost files can be aggravating at the very least. Tremendous amounts of time and effort can be expended fighting viruses once infections start. Investment in a good anti-virus program with regular updates can pay for itself quickly.

II. Connectivity/Network Design

Local Area Network

Ethernet Networks
http://www.ots.utexas.edu/ethernet/

Network Specifications and Standards
http://www.bicsi.org

The Local Area Network (LAN) provides the connectivity among computers and other resources at the local level. The LAN allows computers to communicate with each other and with other networks throughout the rest of the world. A LAN is generally limited to connectivity within a single building or a group of buildings connected on a campus. Proper design and installation of the LAN is crucial to the successful use of technology in the classroom.

Planning a LAN
http://www.svi.org/netday/info/guidebook/

Workstations: Personal Computers (PCs) which are used by students, teachers, and other staff are often referred to as workstations on the LAN. Specifications for workstations may vary based on user requirements. For example, students who are doing Internet research may require different workstations than administrative staff who are running administrative applications such as word-processing and student record keeping systems.

Microsoft Windows/NT Server
http://www.microsoft.com/ntserver/default.asp

Novell NetWare
http://www.novell.com/netware5/index.html

Servers: Servers generally provide added functionality for workstations on the LAN. For example, they may hold applications software which is used by workstations, data which is shared by users, and private data belonging to individual users. They may provide other features such as print services, directory services, and security functions. They might also support communications functions such as e-mail and web server capabilities. The basic rule of thumb for servers is always buy the best you can afford. Adequate memory and disk space should be installed to avoid the need to upgrade in the future. You will grow into and out of it much faster than you think.

Network Operating System (NOS): The Network Operating System is the software which runs on the server. Novell NetWare and Microsoft Windows NT are the dominant Network Operating Systems on the market. Either can be a good solution. Some schools and districts have implemented Unix for either a server operating system, or as the basis for a Web and/or E-mail server.

For the purposes of network management, it is preferable to pick one solution and stick with it network wide. The NOS typically provides file and print services, access control, and various other capabilities which support the users of the network.

Uninterruptible Power Supply (UPS):
Each server should be protected from power outages by connecting it to a UPS. This will provide power in the event of a loss of power from the electric utility company. Most network operating systems will sense the loss of commercial power and will shut down the server if it is not restored in a timely manner. This shutdown will prevent the loss or corruption of data. A UPS should also be used with critical workstations which might lose data if power is lost. They might also be needed for key network components such as routers, hubs, and other electrically powered devices.

Backup system: Each server should have a tape backup system which provides for regular (daily) backups of the software and the data on the server. Regular rotation of backup media should be used, and off-site storage practices should also be followed.

Cabling: Wiring necessary to support communications within the building is a long-term investment. If properly installed, it will support the needs of the school for a long time. Cabling should be based on a structured cabling plan which will support not only data needs but also voice and video in the future. All network components and design factors should conform to technical standards established by appropriate standards bodies where applicable.

Very specific standards, such as the EIA/TIA 568A standards, are available to describe cabling and installation. These standards not only support the communications requirements but also take into consideration other things such as building code and fire protection requirements.

Unshielded twisted pair (UTP) will meet most needs for cabling to workstations and other devices. Category 5 (Cat 5) describes the current preferred minimum cabling installation. Fiber optic cable may be required for connections which exceed the limits of UTP. These standards should be

followed for both the selection of materials and their installation. Select your cable designer/installer carefully, and ensure that he complies with the standards. Also, review SDE facilities requirements, which will cover other aspects of installation, such as building codes and SDE regulations.

Terms, Equipment, Descriptions, and Examples for 1 0BaseT (twisted pair) Networks.
http://web66.umn.edu/Construction/Default.html

While most LANs have been installed using Ethernet 10base-T, which is a shared medium technology, the cabling system supports a migration path toward higher performance networking. For example, the Ethernet hub can be replaced with an Ethernet switch, and 10 megabit Ethernet can be upgraded to 100 megabit Ethernet. Each of these upgrades will improve performance at a relatively low cost. In the future, upgrades to ATM in the WAN as well as in some LANs will provide higher speed bandwidth and will support future applications, such as voice and video.

Resources and Information about Local Area Networks (LANs) with an Emphasis on Data-Communications Technology
http://web.syr.edu/~jmwobus/lans/

Documentation for Local Area Networks (LAN's)'

In new installations and LAN upgrades, documentation is often an afterthought. It should not be. A network installation or upgrade requires several different kinds of documentation prepared and used at different stages of the installation and for ongoing operations. Five categories of documentation are described, each to be started and completed at different times throughout the installation cycle. Whether created and maintained internally by staff or externally by a vendor, documentation is key to the successful future of your Local Area Network.

Network Design Manual with Continuing Updates
http://techweb.cmp.com/nc/netdesign/series.htm

System Operations and Configuration Manual

This manual should provide a complete description of the configuration of the system, including drawings of the physical and logical topology of the LAN. Additionally, it should outline all system administration and operations procedures which must be performed to administer, reconfigure, manage, and maintain effective network operations.

Technical Specifications (EIA/TIA and others)
http://www.hubbell-premise.com/

[1] Gartner Group/Datapro, "Documentation for Local Area Networks." June 13, 1997.

A complete inventory of all components of the system should be maintained with date purchased, serial numbers, and warranty information, as well as other items pertinent to the customer's specific operation.

User's Manual

The user's manual should provide a quick reference guide to basic LAN user operations. It should provide a system overview, introduce network features and capabilities, and provide procedures for basic LAN operations such as logging on or off the network, changing a user password, accessing network applications, and accessing shared file and print services.

Configuration Management Plan

This plan should outline the procedures to be used to request, evaluate, approve, and implement changes to the system design, system documentation, and the installed system.

Quality Assurance and Test Plan

The quality assurance and test plan should describe the overall approach for quality assurance activities. It should identify test and quality assurance objectives; describe the types of testing to be performed (e.g., burn-in testing, subsystem testing, integration testing, and final acceptance testing); provide a schedule for test activities; and describe test reporting requirements.

Training Plan

The training plan should outline all training objectives and the plan for satisfying those objectives. It should describe all courses incorporated in the training program, including training for the system administration personnel as well as help desk support staff and system users.

Troubleshooting Plan

This section should provide a framework for performing troubleshooting procedures for commonly encountered network and site-specific problems. It should identify common symptoms and provide suggested procedures for diagnosing and correcting associated problems. In addition, it should include procedures and associated forms (e.g., repair logs, trouble ticket tracking) for reporting and tracking problems as they are identified and resolved. Historical data should be maintained and scrutinized to identify patterns involving recurring problems.

Maintenance Plan

The maintenance section should discuss the overall maintenance plan and procedures. Appropriate preventive and corrective maintenance procedures should be outlined, and the recommended schedules and type/skill levels of the personnel performing the specified maintenance tasks should be provided. Recommended equipment spare parts levels should be identified.

Report Generation/Performance Monitoring

This section should discuss performance monitoring strategies and procedures. It should discuss data collection and analysis, operation of the networking management software, and generation of management reports. Auditing and performance monitoring of network traffic and services (disk, printer, and server utilization; terminal servers; etc.) should be defined. The section should also define what reports shall be generated and how frequently, as well as describe how these reports should be used to support ongoing planning and engineering as well as troubleshooting.

Points of Contact

This section should document key points of contact, both internally and externally. Internally, the organization and network administrative personnel responsible for each major component of the system should be listed with telephone

numbers for office, pager/beeper, voice mail, and home if policy dictates. Vendors and suppliers should be listed with sales contacts, support resources, and repair procedures.

References

The reference section should include a list of all documentation provided with the system's components, including hardware, software, installation, maintenance, user, and system administration/operations manuals furnished with the system components.

District Wide Area Network

To connect schools within a district together, each district should install a District Wide Area Network (WAN). This connectivity will support communications within school districts and access to statewide resources as well as access to the Internet. Because each school district has unique needs, a WAN for each district must be designed to meet the needs of that district. The District WAN will support sharing of information within the district by allowing access to servers at the various schools and at the district office. It also provides remote support for users, server maintenance, software downloads, and other support related functions.

Circuits to Connect Schools

Schools should work with the South Carolina Budget & Control Board's Office of Information Resources (OIR) to request circuits for each school and district office. OIR will work with the school to provide the appropriate type and speed circuit to connect to the District WAN. OIR reviews the district's requirements and orders the circuit for the school. Depending on various factors and the available technology, OIR may install various types of circuits. These include Frame Relay, Switched Multi-megabit Data Service (SMDS), point to point, and other appropriate types.

Networking Vendors from State Term Contracts:
3Com http://192.156.136.22/erc/index.html

Bay Networks
http://www.baynetworks.com/

Cisco Systems
http://www.cisco.com

The Cisco Educational Archives (CEARCH)
http://www.cearch.org/

Each district should have a central site (typically the District Office) which serves as the control point for its WAN. Each district WAN should have one or more high speed circuits which connect it to the state's backbone network (SCINET).

After installation, OIR will, at the request of the district, evaluate performance on any circuit to determine its utilization. If it is determined that there is congestion on the specified circuit, OIR will upgrade the capacity to a level sufficient to ensure satisfactory performance. In some cases, the district may need to make changes to associated hardware and/or software to implement the upgraded capabilities.

Routers

A router can be used to link LANs together locally or remotely as part of a WAN. A network built using routers is often termed an internetwork. Routers operate at OSI Network Layer (Level Three) and can support particular Network Layer protocols, such as TCP/IP, DecNet and IPX. Most network routers support multiple protocols as necessary to support the devices attached to the LAN. They also support various protocols such as Frame Relay, SMDS, and PPP for WAN connections.

CSU/DSUs

DSU (Data Service Unit) - Data transmission equipment used to interface to a digital telephone circuit to equipment at a user site, typically to a router. It converts the user's datastream to the appropriate signal for transmission over the WAN. A Channel Service Unit (CSU) is often contained functionally within the DSU device. DSUs can convert data to or from a port on a router to a data circuit, such as a 64KBPS or a 1.544 MBPS (T-I) circuit. DSUs must be matched with the line speed of the circuit to which they will be connected.

LAN/WAN Protocols

Data being transmitted from device to device is formatted using specific formats which provide for transmission efficiency. All data transmitted to and from the Internet use a

suite of protocols referred to as TCP/IP. IP addresses are assigned to the schools and districts by OIR. Novell NetWare servers generally use IPX as a communications protocol. IPX is reasonably inefficient and is not transmitted through the SCINET backbone network. Schools are encouraged to migrate from IPX to IP for all communications. Other protocols such as AppleTalk may be used by some schools on their LANs but should not be routed to the WAN.

Web Servers

A Guide for K-12 Schools Wishing to Get on the Internet
http://
198.114.144.101/K12TECH/

While searching the World Wide Web is a way for students to obtain resources from around the world, schools should also use the web as a way to post their own information. Web server technology is relatively easy to implement and should be used by both the school and district staffs as well as by students and teachers. The web server should serve as a location for school/district information which is made available to the community as well as the world.

Many schools and districts are creating web pages to communicate with parents, students, and others in the community. School activities, calendars, meeting notices, and other schedules are just examples of information being delivered. Many teachers are working with students to post information and projects they have developed, often on joint projects with students from other schools around the world. District offices should also be developing intranet technology to distribute information within the district and to support administrative applications.

Web Cookbook
http://web66.umn.edu/Cookbook/Default.html

A web cookbook gives the recipes for setting up an Internet server in a school, or even in a classroom, with links in each recipe so that you can download every ingredient you need.

E-mail Servers

Schools and districts should implement electronic mail (e-mail) as a primary means of communication. At a minimum, e-mail accounts should be provided to administrators, teachers, and staff To the extent practical, e-mail should also be provided to students.

E-mail interchange with the world should be based on Simple Mail Transfer Protocol (SMTP) with appropriate extensions for transfer of graphics, documents, and other embedded objects. E-mail software can frequently be installed on servers used for other purposes, such as file servers or web servers. Software can be obtained free or at relatively low costs. Some districts may choose to implement groupware applications which include functionality such as calendar coordination and document management in addition to e-mail.

Security:

Acceptable Use Policies
http://chico.rice.edu/armadillo/Rice/Resources/acceptable.html

Site Security Handbook
http://ds.internic.net/fyi/fyi8.html

Links to Security Related Sites
http://www.ncsa.com/hotlinks/content.htm

It is the responsibility of each school and district, as well as each user, to ensure the security of all systems and data. This includes the physical security, as discussed in the Physical Design section of this document, and system security. Generally, the greatest threat to system security comes from within the organization. Security begins with a comprehensive security policy. It should focus on system administration as well as user education. Network operating systems provide a substantial amount of security, but it must be properly implemented. School administration must support the policy, and users should be aware of their responsibilities as well as the consequences of violation of the policy.

Consideration should also be given to protection from outside, typically from hackers on the Internet. Protection from the outside can be provided by firewalls, which work in a variety of ways to allow only certain users and data to move into and out of the protected network.

Securing workstations can be a major issue. Users may change the settings of their workstations which can lead to major problems for network administrators. Many products are available on the market which permit full or partial locking of system features. Some of these programs allow multiple logins (different screens and access rights for teachers than for students, for example).

Video Technologies

Media Retrieval Systems: Media retrieval allows for centralization of all audiovisual equipment. Teachers can access and play materials using a remote or a touch tone telephone.

ETV Sites

http://www.scetv.org/AboutETV/insitfs.html

http://www.scetv.org/nts/

http://www.scetv.org/nts/documents/delcs.html

ETV/ITV: Tape and delay centers for short distance learning were begun in South Carolina twenty-five years ago and are now located throughout the state. Today these centers, now referred to as DELC centers, are much more than just facilities that broadcast prerecorded tapes. These centers have become actual live, interactive video production facilities and short distance learning studios.

In addition to classroom instruction, distance learning can provide staff development programs, short courses on test preparation skills and study habit skills, GED training and testing, adult education classes, health education updates, and more. Distance learning interactive courses are being offered more frequently each year. South Carolina is already performing this task on a national level through the Satellite Education Resources Consortium (SERC). This initiative uses satellite technology to bring live, interactive courses in math, science , and foreign language to under-served schools in 23 states. SERC delivers critical subjects and advanced courses to schools that, due to size and budget constraints, could not otherwise offer them. This technology is also available on a local level.

Electronic Video Conferencing
(two-way video and audio)

http://www.coe.missouri.edu/~cjw/video/index. htm

http://www.coe.Missouri.edu/~cjw/video/links.htm

School districts are already seeing the advantages of local live productions. They enjoy the autonomy of assessing and addressing their specific needs. Time and money can be saved by using these facilities for faculty development programs and school support personnel training.

A next step in providing South Carolina's students with equitable access to learning opportunities is to provide two-way video courses, along with professional development and technical assistance for all schools.

III. Physical Design

Computers, projection devices, and networks are essential technology resources for students and teachers. However, the usefulness of these resources and users' satisfaction with them will be directly influenced by the physical environment in which they are placed. Examination must be made of the school as a whole as well as for the individual classroom, computer lab, and technology center.

Building-Wide Issues

Electricity

Is there sufficient power? Calculate the amount of electricity (in amps) that will be used by all of the computer-related equipment to be placed in a room. Work with your physical facilities department to make sure that the electrical circuits serving the room will support this load.

Are there enough electrical outlets and are they located where you need them? Provide the physical facilities department a room diagram that shows where you want to locate computers, printers, scanners, and projectors. A six-plug power strip will support three computers and their monitors. But you do need to make sure that all electrical cords are routed so people won't trip over them.

All computer equipment should be protected from electrical surges. Surge suppression can be built into the electrical circuits that serve a room, or you can use power strips that include surge suppression. Data lines that connect computers to the local area network also need adequate surge suppression.

HVAC

Is there sufficient cooling? Compared with other rooms in schools, computer labs need extra cooling, as computer equipment generates heat. Is the humidity level controlled? If the room's air conditioning is not adequate, large fans and dehumidifiers can help.

Security

What measures need to be taken to assure security of equipment?

Physical Arrangement of Classrooms

Since technology changes the dynamics of instructional delivery, should the room be rearranged? Are there physical structures such as pull down maps or other items that must be worked around or accounted for that need special attention? Students need flat, clear work space around computers. Allow plenty of space around network printers for people and for storing paper, ink, and toner supplies.

Lighting

Is there enough/too much light? Do everything you can to reduce the glare on monitor and projection screens. Wide slat, dark colored Venetian blinds can help control sunlight coming through windows. The glare produced by fluorescent lights can be significantly reduced by adding filtering lenses. Glare can also be reduced by painting walls with a matte rather than a glossy paint.

Can window light be sufficiently blocked? In rooms where projectors are used to display computer images, presenters should be able to reduce the level of ambient light around the projection screen.

Wallboards

Dust generated, especially by chalk, can be very harmful to systems. Have chalkboards been replaced with whiteboards? In rooms where computers are used, chalkboards should be replaced with white marker boards if feasible. Rooms in which computer equipment is located should be vacuumed more frequently than other rooms. Computers have cooling fans that draw in room air and deposit dust on their electrical components. As this dust builds up, the components overheat, which can cause damage.

Furniture

What furniture will need to be added or removed? Compared with carrels, open desks and tables provide more work space and make it easier for teachers and students to communicate and collaborate. Keyboard height and monitor height are important for students' comfort and health. The most common problem is placing keyboards and monitors too high. Avoid this problem by purchasing furniture that fits the students who will be using it. You can also purchase adjustable-height tables and slide-out keyboard trays. Then consider, how can projection best be handled for the room configuration?

Chairs also affect students' comfort, health, and learning. If at all possible, buy chairs that have five wheels (less likely to tip over), good lower back support, and lever or button-controlled height adjustment. Also, to reduce long-term maintenance costs, buy high quality chairs.

IV. Technical Support and Systems Maintenance

Nothing will create a greater level of frustration than to provide hardware and software that is not operational due to inadequate technical support. There are two aspects to maintaining operational systems: human resources and support tools.

Human Resources

Investment in responsive, reliable technical support is critical to successful use of technology in the classroom. If teachers cannot be assured that help is available to keep the system operational and to answer usage questions, they will not use the system. It is vital that individuals are available that are very good at problem solving and interpersonal communications.

Technical Support staff

Technical support staff will be necessary to provide configuration and fix-it services.

In-house vs. Outsourcing/Privatizing (all or parts)

Typically the effectiveness of out-sourced services are measured in terms of average response/closure rate. Advantages to outsourcing can be: ready access to a broader base of expertise (especially in rural areas where hiring local expertise can be a problem), greater flexibility in scaling of services to meet periods of high and low demand, and ability to provide services without additional district/school staffing. Disadvantages can be: loss of control over the individuals doing the service and additional expense. Industry standards typically call for one technician per 200 computers. In education, the ratio is more frequently one technician per 500 computers or more.

Help Desk

Many support problems are related to usage questions for software and systems. A cost effective means of resolving many of these problems is to provide a local or toll-free phone number for a Help Desk staffed by individuals with skills to effectively interpret usage problems and communicate the steps to resolve those problems.

On-site Support Staff

While technically specific assistance might be best delivered from a district level, many technical assistance and usage concerns can best be handled by adequate and appropriate local school staffing. Ideally, each school should have at least one 1.0 FTE dedicated systems support person. This should be an individual that can diagnose and resolve most technical issues and in a non-threatening way provide one-on-one help. The best means to ensure technology will become an integral part of classroom delivery is to supplement staff development efforts with continuing on-site service. This individual should be a part of, or tightly integrated with, the school media/information literacy program.

Support Tools

In order to be effective, technical and on-site school support staff must have appropriate tools in order to be able to do their job. These tools can also have the added benefit of increasing the ability of the end-user to be self-sufficient in the operation of the systems.

Training

Technology changes at an ever increasing rate. In order to adequately provide much needed assistance, regular training must be available to learn new and updated technologies.

Hardware/Software

Every support person will need at least a basic toolkit with a variety of screwdrivers, needlenose pliers, cable line testers, crimpers, anti-static wipes, canned air, disk cleaning tools, spare printer cables, monitor cables, and power cords. It would also be very helpful to provide each technical support person a laptop with a portable CD-ROM drive and tape backup drive. They will also need bootable disks, utility disks, copies of a variety of operating systems (DOS, Win 3.1, Win95, etc.), diagnostics and anti-virus software, and workstation security software.

Reference Material

To be able to effectively research and resolve problems, every support person will need reference manuals. Most valuable is direct access to the Internet where up-to-date data are available and files and other resources are available for downloading. A listing of sites, contacts, and resources would be helpful. Also valuable would be print publications. Many quality technology oriented magazines are available free of charge. Finally, reference manuals and guides appropriate to the hardware, software, and operating systems being used can help speed troubleshooting.

On-going Systems Maintenance

Technology, by nature, is dynamic. Upgrades to hardware, software, and networks will occur at a constant and predictable rate in a well-managed environment. Innovations in the content available for students and teachers, as well as the delivery tools for that content, will continue to evolve. The on-going support and maintenance for a school's system is, therefore, a critical component in the successful deployment of information technology in the classroom.

One of the best references for on-going system support is the manufacturer. All provide written documentation at the time of purchase (either on paper, floppy disc, or CD) and most now maintain Internet sites. These will be key resources for the successful management of your technology environment.

Maintenance

All new system components (e.g. PC's, printers, etc.) should be purchased with strong consideration given to the initial guarantee/warranty period as well as extended plans for support and maintenance. In many cases, a multi-year maintenance contract can be included as a required component of the initial purchase.

Manufacturers have clearly stated recommendations for cleaning, which should be strictly followed. Recommendations for the successful replacement of expendable parts (e.g. print cartridges) should also be noted. All recommendations for proper power supplies and surge and lightening protection should be adhered to, particularly in climates where severe thunderstorms prevail in the summer months. Expensive computer based technology should never be powered by a non-grounded AC source.

Maintenance can be accomplished via three basic methods: an employee can assume responsibility for these functions, a vendor can provide services on an out-sourcing basis, or combination of the above. In any case, good planning will be required so that adequate financial resources can be budgeted on an annual basis.

Obsolescence

The computer technology environment has one of the highest obsolescence rates when compared to other classroom instructional tools like chalkboards and desks. The rapidly evolving ratio of price versus performance in the computer chip alone has seen the industry PC standard move from the 386 to the Pentium processor in just a few years. Many industry experts state that the average life of a PC is now 3-5 years, if the processor can be upgraded along the way. Keyboards, on the other hand, will last longer in a well protected environment and shorter in a high usage environment. Monitors can be adversely affected by sunlight, which will shorten their usable lifespan. In general, the useful life of computer technology has a great deal to do with proper attention to the manufacturer's recommendations and the rapidly evolving nature of the industry.

Upgrades/Refreshes

A well-planned information technology environment will consider and budget for the replacement of a certain percentage of equipment on a yearly basis. If a resource like a PC is given a five year usable life, then financial provisions need to be made for replacing 20% of the PC inventory each year. Creative ways to extend the life of computers should be employed by schools. For instance, allowing students to participate and assist with the upgrade process could be a valuable educational enhancement for the classroom or Computer Club.

Management of software licenses is a critical component of a well planned environment. The proper registration of the user sometimes qualifies for free upgrades in the future, but only if proper licensed ownership can be documented. Be cautious of software upgrades that do not allow for a smooth and seamless transition from one version to another, and check for compatibility between your old files and the new software version before eliminating the older software application. You may want to keep both running for a period of time if there is a compatibility problem and if you have valuable materials stored in an older software version. Illegal use of software is not condoned under any circumstances. A policy should be in place to address school personnel and students loading new applications onto school PCs due to licensing issues as well as hardware capability considerations.

Bibliography

American Association of School Librarians and the Association for Educational Communications and Technology. *Information Power: Building Partnerships for Learning.* Chicago: 1998.

Bialo, Ellen and Sivin-Kachala, Jay. *"The Effectiveness of Technology in Schools: A Summary of Recent Research."* School Library Media Quarterly, Fall 1996, pp. 51-57.

Benton Foundation. *The Learning Connection.* (Online) Available at http://www.cdinet.com/benton/goingon/learning.html, 1995.

The CEO Forum on Education and Technology. *School Technology and Readiness Report: From Pillars to Progress, Year One.* Washington, DC: 1997.

Dede, Chris. *ASCD Yearbook: Learning with Technology.* Alexandria: ASCD, 1998.

Education Commission of the States. *Harnessing Technology for Teaching and Learning.* Denver, CO: Education Commission of the States, 1998.

Gartner Group/Datapro. *Best of Breed and Best Practices.* August, 1997.

Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge. (Online) Available at http://www.ed.gov/Technology/Plan/NatTech Plan. html

Haycock, Ken. *Research Impera fives for Informa tion Professionals: Developing Foundations for Effectiveness.* Morris, Betty, ed. School Library Media Annual. Englewood CO: Libraries Unlimited, 1995.

Jones, Sue. *The Key Elements of Effective State Planning for Educational Technology.* Atlanta, GA: Southern Regional Education Board, 1993.

Lemke, Cheryl and Coughlin, Edward C. *Technology in American Schools: Seven Dimensions for Gauging Progress - A Policymaker's Guide.* Santa Monica, CA: Milken Exchange on Education Technology, 1998.

Miller, Elizabeth B. *The Internet Resource Directory for K-72 Teachers and Librarians,* 97/98 Edition. Englewood, CO: Libraries Unlimited, Inc, 1998.

National Association of Secondary School Principals. *Breaking Ranks: Changing an American Institution.* Reston, VA: NASSP, 1996.

National Study of School Evaluation Technology. *Indicators of Quality Information Technology Systems in K-72 Schools.* Schaumburg, IL: NSSE, 1996.

North Central Regional Educational Laboratory. *Plugging In: Choosing and Using Educational Technology.* (Online) Available at http://www.ncrel.org/sdrs/edtalk/preface.htm

PPI's Education Marketplace. *Technology Plan Facilitator Workshop.* Raleigh, NC: Education Marketplace, Productivity Point International, 1998.

SERVE. *Technology Infrastructure in Schools.* Hot Topic publication for the U.S. Department of Education, Office of Educational Research and Improvement. Talahassee, FL: SERVE.

Southern Technology Council. *Making Technology Happen: Best Practices and Policies from Exemplary K-72 Schools.* Research Triangle Park, NC: Southern Technology Council, 1997.

Thornburg, David. *Reading the Future: Here's What's on Hand for Technology and Education.* Electronic School (Online). Available at http://www.electronic-school.com/0698fl.html.

U.S. Office for Technology Assessment. *Teachers and Technology: Making the Connection.* Washington: OTA, 1995.